

a much shorter wave length than that given by these tests. It follows that the cadmium cell promises to be of great value where measurements of ultra-violet radiation (of shorter wave length than 313μ) are desired. It is shown that this is the case in radio-therapy, since it is this short-wave radiation that is most active in producing pigmentation of the skin.

Upon this point Dorno says:

Correct dosage is of the greatest importance in all radio-therapy; so long as the dosage is based upon the degree of pigmentation of the skin there is need for an instrument giving measurement of intensity exclusively for that spectral region which causes pigmentation. In Figure 2 are drawn (1) the curve of sensitivity of the skin according to Hausser and Vahle in degrees of pigmentation, and (2) the sensitivity of the cadmium cell, both determined by quartz lamp radiation. Curve I is displaced somewhat toward the left of Curve II and descends more slowly in the lower portion of the right-hand branch. However, it is apparent that the cadmium cell almost exactly singles out of this long spectrum of the mercury lamp, extending from about 600 to 230μ (no account being taken of the ultra-red) only that very narrow spectral section which is essential, so far as actions of pigmentation are to be measured, and that within this very narrow spectral section there is found practically the same distribution of energy as that desirable for evaluating the action upon the skin. Therefore, for use in radiation cures, which takes into account the degree of pigmentation, there can hardly be invented a better dosimeter than the cadmium cell. If we attach importance to a better coincidence in the two curves of Figure 2, which will hardly be of great importance in the matter of correct dosage, it is presumable that this could be attained by choosing for a cell wall a uviol glass which offers a somewhat greater hindrance to the passage of the ultra-violet rays.

THE PROBABILITIES OF 0.10 INCH, OR MORE, OF RAINFALL AT SPRINGFIELD, ILL.

551.578.1 (773)

By WALTER F. FELDWISCH

[Weather Bureau, Springfield, Ill., August 27, 1924]

The great majority of rain-insurance policies are written on the basis of 0.10 inch precipitation occurring within a specified time. Those who contemplate insuring events frequently inquire of Weather Bureau officials as to what hours during the day rain is most likely to occur, and they especially desire to know the probability of a fall of 0.10 inch or more. Computations showing the average relative depth of fall for each hour are very valuable, but the rate of fall may vary decidedly for the different hours and it may be possible that though rain falls more frequently at certain hours than at others, nevertheless the showers at that particular time of day have a tendency to be so light or of such short duration that frequently the total will not be brought up to the 0.10 inch required to collect the insurance.

Computations have been made for the Springfield, Ill., station, showing the actual percentage of times an amount of 0.10 inch or more of precipitation occurred within specified time limits, and the result is shown in Table 1. As would naturally be supposed, the table indicates that the greater the number of hours included in a period the greater becomes the probability of 0.10 inch within the specified hours for the different times of the day. So, while in May, for instance, in considering six-hour periods, one inspecting the total hourly falls as shown by Table 2 and Figure 1, and the percentages as shown by Table 3, might be inclined to think the hours from midnight to 6 a. m. better for the insured from a monetary point of view than those from 12 noon to 6 p. m. by a margin of 2 to 1, provided rates for all hours are equal, nevertheless this supposition is not borne out by the figures of Table 1. Furthermore, Table 1 shows that in May there is, on the average, less probability of 0.10 inch occurring within six hours following the individual hours 6 a. m. to 11 a. m. than for those of 12 noon to 6 p. m., while Table 3 shows that a slightly greater percentage of the 24-hour amount occurs between 6 a. m. and 12 noon

Part 3 of the paper, Heft 9 : 276-277 is devoted to a discussion of the Michelson bimetallic actinometer, which has been in use at Davos with satisfactory results since 1909, when two of these instruments were purchased from Moscow. A third was obtained in 1914, likewise from Moscow, and with the three instruments more than a million measurements have been made, at the surface of the earth from sea level to elevations of 3,500 meters, at sea, and on balloon flights, without damage to the instruments, and with little change in their standardization constants. Dorno speaks of them as reaching a stable condition within 10 or 15 seconds after exposure, and following closely all variations in atmospheric transmission. A not irrelevant temperature correction is required by the first two instruments belonging to the type described in *Physikalische Zeitschrift*, 1908, page 18, and following pages, whereas the third, one belonging to the type described in the *Meteorologische Zeitschrift*, 1913, page 577, does not show any greater dependence upon the temperature than that cited with examples by Professor Michelson, being thus quite extraordinarily independent of temperature oscillations.

The data relating to the various tests are presented in tables and also in diagrams.

In preparing this summary the writer has made use of an English text prepared by Dorno. This text included Figure II which does not appear in the original paper.

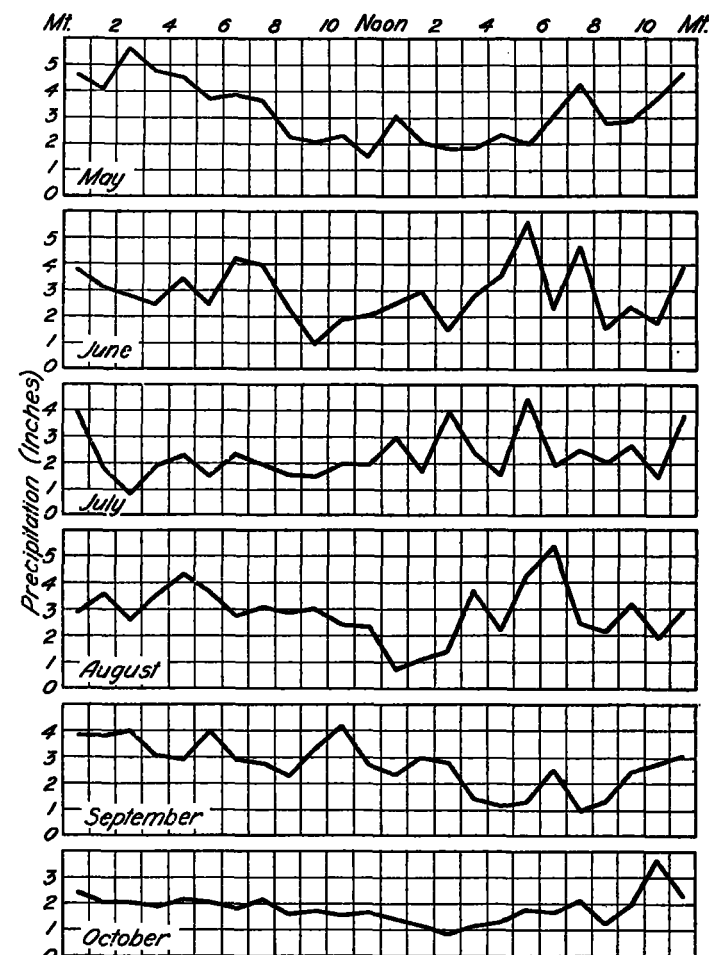


FIG. 1.—Total hourly amounts of precipitation, May to October, for the 19 years 1905-1923, inclusive, at Springfield, Ill. Data from Table 2

than between 12 noon and 6 p. m. Other instances of a similar character, though hardly so pronounced, may be seen in other months.

A careful consideration of Table 1 may sometimes prove of value in answering inquiries as to the local forecast on days when the precipitation forecast is what is termed "indefinite." A judicious use of such a table in connection with observed local conditions may sometimes enable the forecaster to give information of value in regard to what hours precipitation is most likely to occur during the period of such "indefinite" forecast. Moreover, under conditions when the occurrence of any precipitation appears doubtful, or if the precipitation

area is moving as a narrow strip of intermittent scattered showers, if the local forecast official can determine pretty definitely at what hour the conditions can be expected to be most favorable for precipitation at his station, the table may be an aid in deciding whether or not rain should be forecast. Thus, if barometric or other conditions most favorable for precipitation are due to pass over the station at an hour when the table shows rain to occur infrequently, the wording of the forecast may differ somewhat from that given when it is seen that conditions most favorable for precipitation will pass over the station at a time when the table shows a relatively high frequency of precipitation.

TABLE 1.—Percentage frequency of the occurrence of 0.10 inch or more precipitation within 1, 2, 3, 4, 5, and 6 hours beginning at midnight, 1 a. m., 2 a. m., etc., for 24 hours¹, at Springfield, Ill. (years 1905-1923, inclusive)

MAY																									
Period (hours)	Period beginning at—																							Mean	
	A. M.											P. M.													
	Mid- night	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10		11
1-----	2.2	3.1	2.7	2.4	1.9	2.5	1.4	1.2	0.7	1.2	0.8	1.5	1.2	0.7	1.0	1.4	1.2	1.9	2.4	1.2	1.2	1.7	2.9	2.2	1.8
2-----	4.9	5.1	4.2	4.1	4.4	3.4	2.5	2.4	1.9	2.0	2.0	2.2	2.5	2.0	2.9	2.5	2.9	3.4	3.1	2.7	2.7	4.1	4.6	3.1	3.2
3-----	6.4	6.3	5.9	6.3	5.1	4.1	3.4	3.1	2.5	2.9	2.5	3.2	3.9	3.7	3.7	3.7	4.4	3.9	4.6	4.2	4.9	5.3	5.1	5.4	4.6
4-----	7.5	7.0	8.3	7.0	5.8	5.1	4.6	4.1	3.4	3.6	3.7	4.6	5.4	4.4	4.6	5.4	5.1	5.6	6.3	5.9	5.9	5.9	7.1	6.6	5.6
5-----	8.5	9.0	8.7	7.6	7.1	5.9	4.9	4.8	3.9	4.6	4.8	5.9	6.1	5.3	6.1	5.8	7.0	7.1	7.8	6.8	6.6	8.1	8.3	8.0	6.6
6-----	10.5	9.8	9.2	8.5	7.8	6.3	5.6	5.3	4.9	5.6	6.1	6.6	7.1	6.8	6.5	7.6	8.5	8.8	8.5	7.3	8.8	9.3	9.5	8.5	7.6
JUNE																									
1-----	1.4	1.4	1.2	1.8	1.1	1.6	2.1	0.9	0.5	0.9	1.1	0.9	1.1	0.7	1.6	1.4	1.9	1.2	1.2	0.7	0.5	1.1	1.9	0.9	1.2
2-----	2.3	2.8	3.0	3.0	2.5	3.5	3.0	2.3	1.4	1.8	1.9	1.8	1.4	2.1	3.2	2.8	2.5	2.3	2.1	1.1	1.6	2.3	2.1	2.3	2.3
3-----	3.3	4.2	4.0	3.9	4.0	4.2	4.0	2.8	2.1	2.5	3.0	2.3	3.0	3.5	4.6	3.5	3.5	3.0	2.8	2.3	2.5	2.3	3.2	3.0	3.2
4-----	4.7	5.3	4.7	5.6	4.7	4.9	4.4	3.5	2.8	2.6	3.5	4.0	4.4	4.9	5.4	4.7	4.4	3.0	3.3	3.2	2.5	3.2	3.5	4.2	4.0
5-----	5.6	6.0	6.3	6.1	5.4	5.3	5.1	4.2	3.9	4.0	4.9	5.4	5.8	5.8	6.5	5.4	4.4	4.2	4.2	3.3	3.3	3.5	4.6	5.4	4.9
6-----	6.3	7.5	6.8	6.7	6.8	6.1	6.0	5.1	4.4	5.3	6.5	6.8	6.5	6.8	7.4	5.4	5.4	5.1	4.4	4.2	3.7	4.6	5.6	5.8	5.8
JULY																									
1-----	1.0	0.5	1.2	1.0	0.8	0.8	1.0	1.0	0.8	0.8	0.7	1.7	0.5	0.7	0.7	0.8	1.0	1.2	1.0	1.4	1.2	0.8	1.5	1.2	1.0
2-----	1.5	2.0	2.0	1.5	1.9	1.5	1.5	1.5	1.4	1.2	2.0	2.2	1.0	0.8	1.5	1.7	1.7	2.0	2.0	2.2	2.0	2.2	2.4	2.4	1.7
3-----	2.9	2.9	2.5	2.7	2.7	2.0	2.0	2.0	1.7	2.2	2.5	2.7	1.2	1.7	2.2	2.4	2.2	2.9	2.7	3.1	3.4	3.1	3.4	2.9	2.5
4-----	3.6	3.4	3.6	3.4	3.2	2.5	2.4	2.4	2.7	2.7	3.1	2.9	2.0	2.4	2.9	3.1	3.1	3.6	3.6	4.2	4.2	3.9	3.7	4.1	3.2
5-----	4.1	4.4	4.4	3.9	3.7	2.9	2.7	3.6	3.1	3.2	3.2	3.7	2.7	3.2	3.4	3.9	3.7	4.4	4.9	5.1	5.3	4.4	4.9	4.8	3.9
6-----	5.1	5.1	4.9	4.2	4.1	3.2	3.9	4.1	3.6	3.6	3.9	4.2	3.6	3.7	4.2	4.8	4.6	5.8	5.8	5.8	5.6	5.4	5.6	5.3	4.6
AUGUST																									
1-----	1.7	1.4	2.0	2.2	1.7	1.5	1.4	1.4	1.4	1.7	1.0	0.3	0.5	0.8	1.2	1.2	1.5	2.5	1.0	1.2	1.5	1.5	1.7	1.4	1.4
2-----	2.5	2.9	4.1	3.1	2.7	3.1	2.5	2.5	2.7	2.7	1.0	0.7	1.0	2.0	2.0	2.4	3.6	3.2	2.0	2.4	2.4	2.5	2.2	2.2	2.4
3-----	3.6	4.7	4.7	3.9	4.2	4.2	3.4	4.1	3.4	2.7	1.4	1.2	2.0	3.1	3.6	4.4	4.2	4.1	3.1	3.6	3.6	2.9	2.9	2.9	3.4
4-----	4.6	5.3	5.4	5.3	5.4	5.1	4.8	4.6	3.6	3.1	1.7	2.2	2.9	4.4	5.6	5.3	5.4	5.1	4.2	4.6	3.9	3.6	3.4	3.7	4.4
5-----	6.3	5.9	6.6	6.3	5.9	6.3	5.3	4.6	4.1	3.6	2.9	3.2	4.2	6.5	6.5	6.5	6.1	6.1	5.1	4.9	4.6	4.1	4.2	5.3	5.3
6-----	7.0	7.1	7.6	6.8	7.1	6.8	5.3	4.9	4.4	4.8	4.2	4.4	6.3	7.0	7.5	7.1	7.3	7.0	5.4	5.6	5.1	5.1	5.8	5.9	6.1
SEPTEMBER																									
1-----	1.9	2.5	1.6	1.9	1.6	1.2	1.8	1.6	1.9	2.1	1.4	1.1	1.6	1.8	0.4	0.5	0.5	1.2	0.5	0.9	1.6	1.4	1.1	1.9	1.4
2-----	3.9	3.5	3.3	2.6	2.8	3.0	3.2	3.2	3.9	3.0	2.5	2.6	2.5	1.9	1.2	1.2	1.8	1.4	1.2	2.1	2.6	2.3	3.2	4.0	2.6
3-----	4.9	4.7	4.2	4.4	4.2	3.9	4.7	4.6	4.7	3.9	3.5	3.5	2.6	2.6	1.8	2.5	2.1	1.9	2.6	3.3	3.3	4.0	4.4	4.9	3.7
4-----	6.1	5.4	5.6	5.3	5.1	5.1	5.8	5.3	5.4	4.7	4.2	3.7	3.2	3.2	2.8	2.8	2.6	3.2	3.5	3.9	5.6	5.3	5.3	5.8	4.6
5-----	6.7	6.5	6.5	6.1	6.5	6.1	6.3	5.1	6.3	5.8	4.6	4.2	3.9	4.6	3.2	3.5	4.0	4.0	4.2	5.8	6.5	6.1	6.1	6.8	5.4
6-----	7.7	7.5	7.2	7.4	7.2	6.8	7.0	7.0	7.2	6.0	4.9	4.9	4.9	4.9	3.9	4.6	4.7	4.6	6.1	6.8	7.4	6.7	7.0	7.2	6.3
OCTOBER																									
1-----	1.2	1.2	0.7	1.4	0.5	0.7	1.5	1.0	1.2	0.8	0.8	0.8	0.7	0.3	0.7	0.8	0.5	0.8	1.0	0.5	1.0	1.9	1.2	1.4	1.0
2-----	2.7	2.5	2.2	2.0	1.5	2.0	2.4	2.2	1.9	1.7	1.9	1.9	1.2	1.4	1.5	1.9	1.9	2.0	1.9	2.2	3.6	3.4	3.1	2.2	2.2
3-----	3.7	3.9	3.1	3.1	3.1	3.1	3.2	2.7	2.7	2.5	2.5	2.2	2.0	1.7	2.0	2.9	2.5	2.4	3.1	4.1	4.4	4.8	3.6	3.7	3.1
4-----	4.9	4.8	4.4	4.8	3.7	3.6	3.7	3.2	3.2	3.1	2.9	3.1	2.2	2.4	3.1	3.6	3.1	3.7	4.8	4.9	5.6	5.4	5.1	4.6	3.9
5-----	5.4	5.8	5.6	4.9	4.2	4.1	4.2	3.9	3.9	3.9	3.6	3.2	2.7	3.1	3.7	4.1	4.8	5.6	5.6	5.8	6.1	6.1	5.4	5.8	4.6
6-----	6.8	6.8	5.8	5.4	4.6	4.6	4.6	4.4	4.4	4.2	3.7	3.7	3.6	3.9	4.2	5.1	6.3	6.3	6.6	6.3	6.8	6.5	6.6	6.3	5.3
MEANS, MAY-OCTOBER, INCLUSIVE																									
1-----	1.6	1.7	1.6	1.8	1.3	1.4	1.5	1.2	1.1	1.2	1.0	1.0	0.9	0.8	0.9	1.0	1.1	1.5	1.2	1.0	1.2	1.4	1.7	1.5	1.3
2-----	3.0	3.1	3.1	2.7	2.6	2.8	2.5	2.4	2.2	2.1	1.9	1.9	1.6	1.7	2.0	2.1	2.4	2.4	2.0	2.1	2.5	2.8	2.9	2.7	2.4
3-----	4.1	4.4	4.1	4.0	3.9	3.6	3.4	3.2	2.8	2.8	2.6	2.5	2.4	2.7	3.0	3.2	3.2	3.0	3.1	3.4	3.7	3.7	3.8	3.8	3.4
4-----	5.4	5.2	5.3	5.2	4.6	4.4	6.3	3.8	3.5	3.4	3.2	3.4	3.4	3.6	4.1	4.2	4.0	4.0	4.3	4.4	4.6	4.6	4.7	4.8	4.4
5-----	6.1	6.3	6.4	5.8	5.5	5.1	4.8	4.4	4.2	4.2	4.0	4.3	4.2	4.8	4.9	4.9	5.0	5.2	5.3	5.3	5.4	5.4	5.6	6.0	5.1
6-----	7.2	7.3	6.9	6.5	6.1	5.6	5.4	5.1	4.8	4.9	4.9	5.1	5.3	5.5	5.6	5.8	6.1	6.3	6.1	6.0	6.2	6.2	6.7	6.5	5.9

¹ The method of arriving at these percentages may be illustrated as follows: Taking the first entry under midnight, 2.2 per cent, this was obtained by counting the number of hours in which 0.10 inch or more of rain fell between the hours of midnight and 1 a. m. in May. In the 19 years this occurred 13 times. As there are 31 days in May, multiplying 31 by 19 gives 589 as the possible number of hours in which 0.10 inch or more could have occurred; then dividing the actual number (13) by the possible number (589), the result is 2.2 per cent.

TABLE 2.—Total hourly amounts of precipitation, May to October, for the 19 years 1905-1923, inclusive, at Springfield, Ill.

	Hour beginning at—																							
	A. M.											P. M.												
	Mid- night	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11
May.....	4.64	4.04	5.69	4.77	4.54	3.68	3.86	3.66	2.20	2.04	2.28	1.47	3.05	2.03	1.79	1.63	2.32	2.00	3.15	4.27	2.77	2.87	3.78	4.67
June.....	3.81	3.13	2.84	2.49	3.43	2.47	4.19	3.96	2.23	.95	1.87	2.00	2.44	2.95	1.44	2.75	3.53	5.66	2.26	4.62	1.49	2.36	1.70	3.87
July.....	3.96	1.85	.85	1.94	2.30	1.52	2.33	1.93	1.57	1.47	1.96	1.95	3.00	1.64	3.98	2.36	1.67	4.47	1.96	2.47	2.04	2.65	1.62	3.79
August.....	2.90	3.57	2.60	3.55	4.29	3.68	2.74	3.04	2.88	3.02	2.41	2.32	.69	1.11	1.39	3.62	2.14	4.21	5.37	2.42	2.13	3.16	1.90	2.92
September.....	3.81	3.81	3.97	3.07	2.89	3.97	2.87	2.74	2.26	3.29	4.18	2.70	2.33	2.98	2.79	1.40	1.12	1.27	2.52	.99	1.30	2.41	2.75	3.02
October.....	2.43	2.05	2.07	1.86	2.15	2.04	1.86	2.15	1.62	1.75	1.59	1.68	1.41	1.18	.86	1.16	1.32	1.78	1.68	2.16	1.21	1.98	3.68	2.29
Mean.....	3.59	3.08	2.99	2.96	3.27	2.89	2.98	2.91	2.13	2.09	2.38	2.02	2.15	1.98	2.04	2.02	2.00	3.23	2.82	2.82	1.82	2.57	2.56	3.43

TABLE 3.—Percentage of monthly precipitation occurring during 6-hour periods, May to October, inclusive, Springfield, Ill.

Month	Midnight to 6 a. m.	6 a. m. to noon	Noon to 6 p. m.	6 p. m. to midnight	Month	Midnight to 6 a. m.	6 a. m. to noon	Noon to 6 p. m.	6 p. m. to midnight
May.....	Per cent 34	Per cent 19	Per cent 17	Per cent 30	September.....	Per cent 32	Per cent 27	Per cent 19	Per cent 22
June.....	27	20	27	26	October.....	28	23	18	31
July.....	19	22	29	30	Mean.....	29	22	22	27
August.....	30	21	26	23					

551.578.1 (794)

HOURLY RAINFALL AT LOS ANGELES, CALIF.

By GEORGE M. FRENCH
[Weather Bureau, Los Angeles, Calif.]

During the past year or two there has been considerable discussion, in connection with the subject of rain insurance, as to the periods of the day in which the greatest and least frequency of rainfall occurs. It has therefore occurred to the writer that it might be of interest to obtain definite information on the subject by making an analysis of the records of hourly rainfall at Los Angeles. At the same time it appeared to be worth while to determine the hours in which the greatest and least amounts of rain fell. The results of this investigation are set forth in the following note.

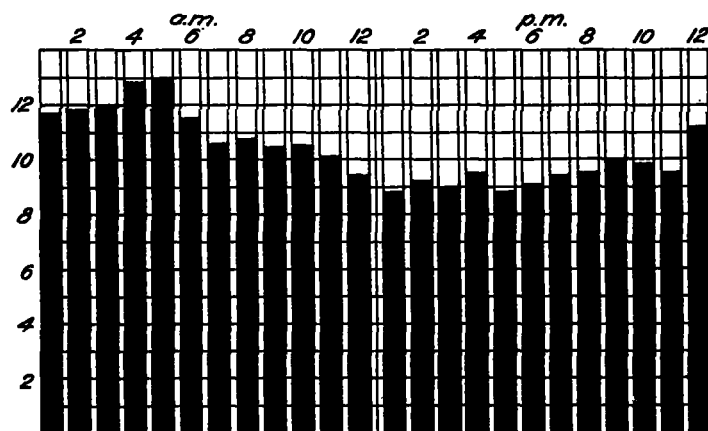


FIG. 1.—The annual average frequency of precipitation (0.01 of an inch or more) for each hour of the day at Los Angeles, Calif., 1905 to 1913, inclusive

It appeared to be the general belief of those with whom the subject was discussed that rain at Los Angeles occurred most frequently and in greatest amount during the night. If we designate 6 p. m. to 6 a. m. as night and 6 a. m. to 6 p. m. as day, this belief is substantiated by the data which form the basis of Figures 1 and 2. There is an increase in frequency during the night of 14 per cent over that of the day, and an increase in total amount during the night of 23 per cent above that of the day. It is interesting to note that not only are the total hourly amounts of rain for the early morning hours greater, as would be expected with a greater frequency, but the increase in amount greatly exceeds the increase in frequency. The greatest frequency is 47 per cent more

than the least frequency while the greatest amount of rain is 91 per cent more than the least amount.

In studying Figure 1, as a possible aid in forecasting, it is found that the forecast period 5 p. m. to 5 a. m. shows greater frequency of rainfall than the period 5 a. m. to 5 p. m., but probably this difference is not sufficient to be of any material help in forecasting.

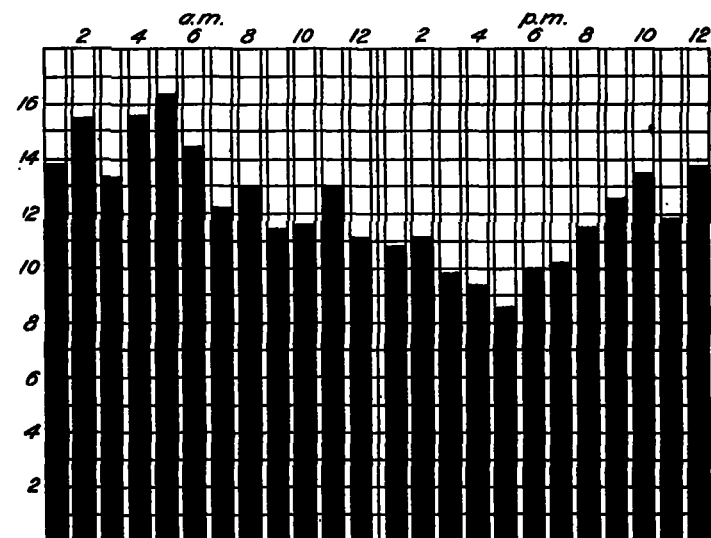


FIG. 2.—The total rainfall in inches for each hour of the day at Los Angeles, Calif., 1905 to 1913, inclusive

The results obtained by tabulating these data show that the greatest frequency of rainfall at Los Angeles is between 4 and 5 a. m. This is also true of the greatest amount. The least frequency is from 12 noon to 1 p. m. and also 4 to 5 p. m., and the least amount occurs between 4 and 5 p. m.

In considering these figures it must be remembered that this is a region of very light rainfall, the average annual amount being only 15.37 inches, so that a single excessive rain occurring in a given hour might bring the total of that hour considerably higher than that of the preceding and following hours. It would probably require a study of a period covering a great many years to smooth out the irregularities entirely.